It’s Just a Water Heater.

What is the difference between a water heater and hot water supply boiler?

What laws and codes are applicable?

What are the safety concerns?

Installation No No’s.

HISTORY

In the 1870s, Englishmen, Maughan invented the first instant water heater. Little is known about Maughan's invention, however, his invention influenced the designs of Edwin Ruud.

Edwin Ruud, a Norwegian mechanical engineer was the inventor of the automatic storage water heater in 1889. Ruud emigrated to Pittsburgh where he pioneered the early development of both residential and commercial water heaters.

DEFINITIONS

Webster defines a water heater as an apparatus for heating & usually storing hot water. One of the definitions it has for boiler is a tank in which water is heated or hot water is stored. (As for supplying hot water.)

ASME – (HLW) only defines both, hot water supply boilers and potable water heaters as not to exceed any of the following limitations.

- *Max operating temp of 210 degrees F*
- *Max allowable working pressure of 160 psi*
- *Minimum pressure of 100 psi*

SERVICE RESTRICTIONS –

- *Only when heat input is 200,000 BTU or greater*
- *Nominal water capacity of 120 gallon or more*

ASME – (H) defines low pressure heating boilers and hot water supply boiler as not exceeding any of the following limitations.

- *Max allowable working pressure of 160 psi*
- *Max temp of 250 degrees F*
- *Steam boilers not to exceed 15 psi*

Hot water supply boiler/potable water heaters constructed under 200,000 BTU input or 120 gallon capacity is regulated by the US Department of Energy.

DEFINITIONS CONT'D

44-914 Definitions. As used in this act, unless the context otherwise requires:

(a) "Boiler" means a closed vessel in which water or other liquid is heated, steam or vapor is generated or steam is superheated, or in which any combination of these functions is accomplished, under pressure or vacuum, for use internal or external to itself, by the direct application of energy from the combustion of fuels or of electric or solar power. The term boiler shall also include fired units for heating or vaporizing liquids other than water where these units are separate from processing systems and are complete within themselves.

(b) (g) "Hot water supply boiler" means a vessel heating water for external uses, by gas, oil, electricity or solar energy that does not exceed 160 psi, or 210° Fahrenheit.

There are a variety of Codes which govern installation.

For ASME constructed objects –

- NBIC (National Board Inspection Code)
- ASME (CSD-1)
- Uniform Mechanical Code
- Uniform Plumbing Code
- NFPA (National Fire Protection Association)
- Local Jurisdiction Code (State Boiler Code or Municipal Codes)
- Manufacturer recommendations

44-929 Exclusive jurisdiction of state over boiler safety. No city, county or other political subdivision of this state shall have the power to make any laws, ordinances or resolutions providing for the construction, installation, inspection, maintenance and repair of boilers or any pressure vessels installed after January 1, 1999, within the limits of such city, county or political subdivision, and any such laws, ordinances or resolutions heretofore made or passed shall be void and of no effect.

Therefore, it is most important to have a good working relationship with your boiler inspector to gain information and advice from in order to make sure that you end up with a complete installation.

So what does Kansas consider?

As mentioned before, every state has its own set of rules for the governing of boilers and the laws associated.

KANSAS –

- Hot water supply boilers (includes fired storage water heaters)
- Heat input of 200,000 BTU or greater (must be ASME constructed)
- MAWT 210 degrees
- Nominal water capacity of 85 gallons or more (not required to be ASME constructed if under 120 gallons)

44-915 Act inapplicable to certain boilers and pressure vessels.

heating boilers and pressure vessels which are located in private residences or in apartment houses of less than five family units;

RECOMMEND GOING TO THE FOLLOWING LINK:

https://firemarshal.ks.gov

Installations in KS

The following is only a few selected highlights as it pertains to hot water supply boilers installed in accordance w/ Kansas statutes.

44-925 Installation and operation violations; penalties. (a) It shall be unlawful for any person, firm, partnership, corporation or other entity to operate in this state a pressure vessel installed after January 1, 1999, or a boiler without a valid inspection certificate. The operation of a pressure vessel installed after January 1, 1999, or a boiler without such inspection certificate or at a pressure exceeding that specified in such inspection certificate shall constitute a class C misdemeanor. Each day of such unlawful operation shall be deemed a separate offense.

(d) In addition to any other penalty provided by law, the state fire marshal, upon finding that any person has violated any of the provisions of this act or any rule or regulation promulgated under the authority of this act, is authorized to impose a civil penalty not to exceed $1,000 per violation for each day of such unlawful operation, which shall constitute an actual and substantial economic deterrent to the violation for which the penalty is assessed. No civil penalty shall be imposed pursuant to this subsection except upon the written order of the state fire marshal to the person who committed the violation. Such order shall state the violation, the penalty to be imposed and the right of the person to request a hearing as provided in K.S.A. 44-928, and amendments thereto.

Installations in KS cont'd

49-50-20 New boilers, new boiler rooms, and boiler clearances.

(a) Each owner, user, and installer of a new boiler shall be responsible for notifying the office of the chief inspector within 72 hours of a boiler installation.

The installation instruction manual shall remain available to the authorized inspector upon the inspector's request.

Article 50.—GENERAL REQUIREMENTS FOR ALL BOILERS

49-50-8 Piping system.

(i) Hot water supply boiler installations shall be inspected for conformance with section IV of the ASME heating boiler code. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-50-22 Venting of atmospheric vents, gas vents, and bleed or relief lines.

(a) Each gas pressure regulator, pressure switch, safety shutoff valve, and any other gas control that has a threaded fitting shall be vented to the outdoors to a safe point of discharge. The material for each vent line shall be metallic, in accordance with the standards in NFPA 54, which is adopted in K.A.R. 49-50-2.

Installations in KS cont'd

49-52-18 Hot water supply boilers.
(e) Each hot water supply boiler that requires electricity to power burners, to stack dampers, or to start an electronic ignition shall be hardwired into the facility's electrical system.
(Authorized by and implementing K.S.A. 44-916; effective Nov. 3, 2006)

49-52-17 Emergency shutoff switches.
An emergency shutoff switch shall be installed on each hot water supply boiler, on each boiler of any size that is equipped with power burners, and on each boiler with a BTUH input of 400,000 or more, regardless of burner type.

49-52-8 Pressure or altitude gauge and thermometers.
(1) The thermometer is easily readable during observation of the water pressure or altitude gauge,
(2) The thermometer will at all times indicate the temperature, in degrees Fahrenheit, of the water in the boiler at or near the outlet.
(e) **Each hot water supply boiler shall have a thermometer installed in the hot water supply line.** (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

Installations in KS cont'd

49-52-6 Safety relief valve requirements for hot water boilers and hot water supply boilers.

(f) The safety relief valve capacity for each boiler shall be sufficient to prevent the pressure from rising more than 5 psig above the boiler's maximum allowable working pressure with the fuel-burning equipment installed. **Each storage water heater and each hot water supply boiler shall have T & P relief valves with a relieving capacity and an American Gas Association rating that is equal to or exceeds the burner BTUH input or the electrical power kilowatt input.** Each hot water supply boiler that is of the coil or water tube type shall be equipped with a safety relief valve. The connecting hot water storage tank shall have a pressure and temperature safety relief valve with a temperature-relieving capacity equivalent to the total burner BTUH input.

(g)(1) Each safety relief valve shall be installed in a vertical position, except for T & P relief valves that are installed on storage water heaters equipped with side tappings to accommodate the insertion of the T & P valve thermostat. The T & P valve thermostat shall be immersed in the water and located in the top six inches of the vessel. No valve of any type shall be placed between the safety relief valve and the boiler or on the discharge pipe between the safety relief valve and the atmosphere.

(3) All safety relief valve discharges shall be located or piped in a manner that does not endanger persons working in the area. If discharge piping is directed downward, the pipe shall terminate no more than six inches above floor level. Plastic discharge piping shall not be used on any safety relief valve discharge line, including discharge lines for domestic hot water heaters of any size.

Installations in KS cont'd

49-52-8 Pressure or altitude gauge and thermometers.

(e) Each hot water supply boiler shall have a thermometer installed in the hot water supply line. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective May 1, 1987; amended April 28, 2000.)

49-52-16 Provisions for thermal expansion in hot water supply systems. If the system is equipped with a check valve or pressure reducing valve in the cold water inlet line, an airtight expansion tank or other suitable air cushion shall be used. If provided, the tank shall be constructed according to the requirements of section VIII, division 1 of the ASME code, with a maximum allowable working pressure to equal or exceed the working pressure of the hot water supply boiler. (Authorized by and implementing K.S.A. 1998 Supp. 44-916; effective April 28, 2000.)

49-52-18 Hot water supply boilers. (a) No hot water supply boiler or commercial or domestic type of water heater of any size shall be used for any type of comfort heat. This prohibition shall include floor heat and closed-loop hot water heating systems of any kind. Each boiler that is used for heating purposes and is not made of cast iron shall be code-stamped and registered with the national board of boiler and pressure vessel inspectors.

(b) No hot water heating system shall be connected with any domestic hot water system or be used in combination as a building heating system and domestic hot water system.

(c) No hot water supply boiler code-stamped ‘‘HLW’’ shall be used for any kind of comfort heat.

(d) For the purposes of each boiler certification inspection, when a hot water supply boiler is connected to a hot water supply tank, this combination shall be considered one unit.

(e) **Each hot water supply boiler that requires electricity to power burners, to stack dampers, or to start an electronic ignition shall be hardwired into the facility's electrical system**. (Authorized by and implementing K.S.A. 44-916; effective Nov. 3, 2006)

POP QUIZ HOTSHOT

You're walking a facility and happen see a fired storage water heater in a room, that you haven't noticed before. It is 86 gallon w/ a burner input of 199,000 BTU. There are no certificates posted, but does it even require an inspection?

YES

You notice an electric water heater in your factory. It is in a small closet w/in a bathroom. It is 50 gallon, and a total output of 12.5 killowatt . You notice it has an expired certificate. Will this require an inspection?

NO – However, you might want to verify your findings w/ the State.

You are in charge of a large 4 residential apartment building. You have a 100 gallon, 199,000 BTU water heater in the basement laundry room. It has never been inspected, you notice no certificates. Does this require an inspection?

NO

WHEN IN DOUBT, CALL YOUR LOCAL JURISDICTION TO VERIFY.

Video #2 News Explosion

SAFETY

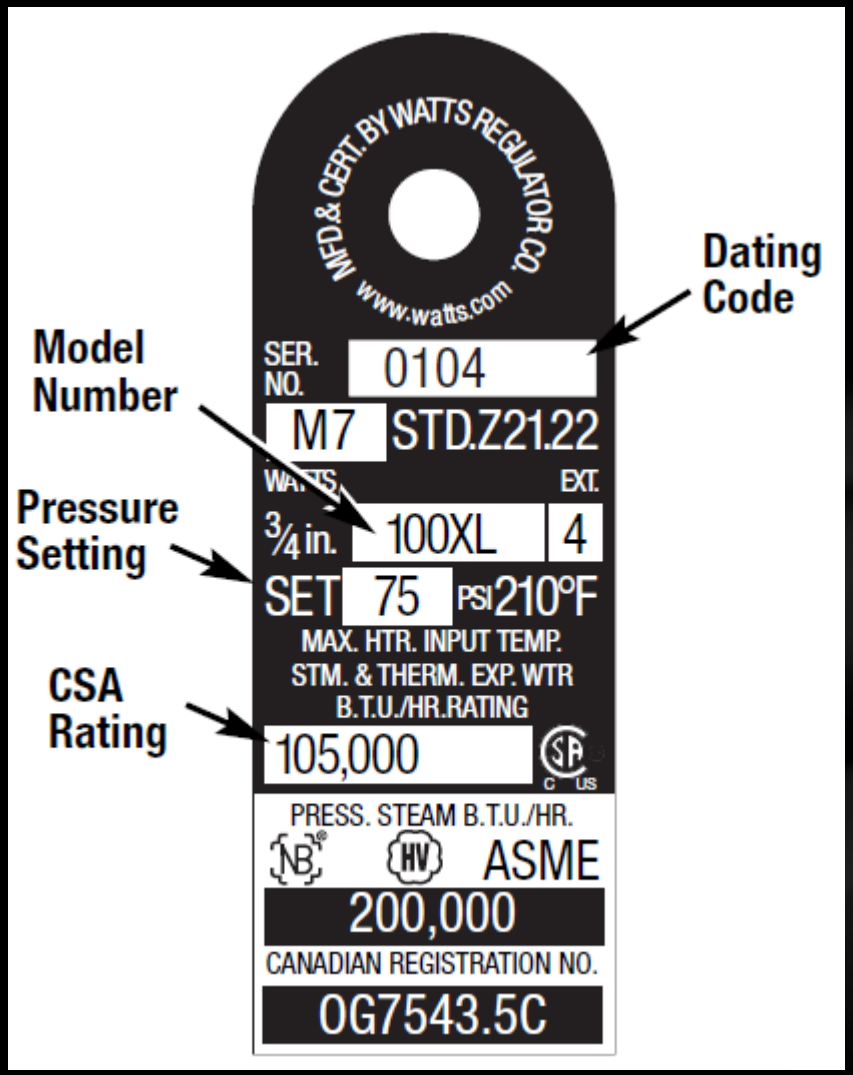
The standard safety features for a non-ASME, fired storage water heater.

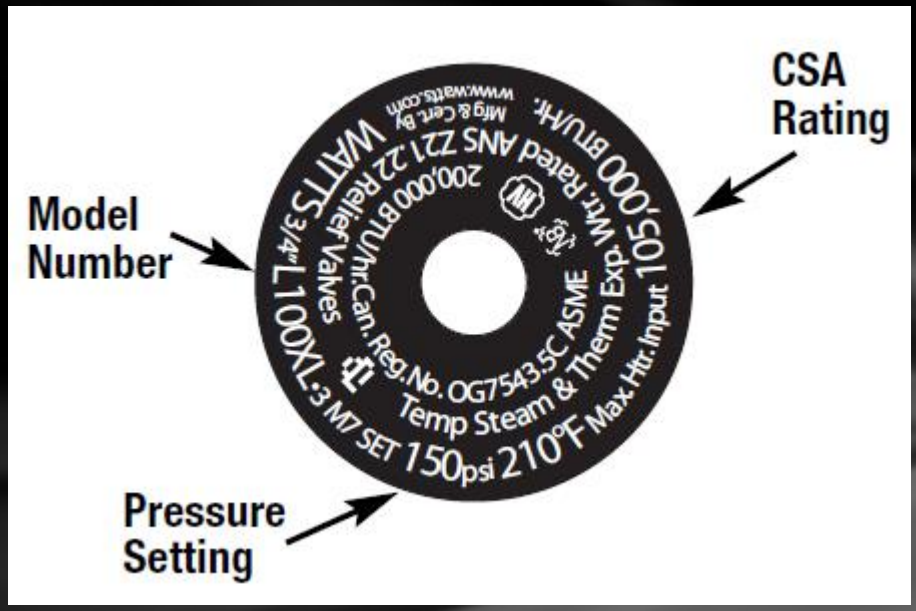
- One single stage, open/close safety gas shutoff valve.
- One electronic/millivolt temperature sensor.
- One T&P safety relief valve.

The standard features for an ASME, fired storage water heater.

- Dependent upon the BTU input and burner type, must comply w/ CSD-1. (This includes the need for the installation of an emergency shutoff at each exit.)
- One electronic/millivolt temperature sensor.
- One electronic/millivolt temperature sensor with manual reset.
- Minimum, one T&P safety relief valve. (This will depend upon the stated BTU input on the manufacture data plate/sticker.

THE T&P SAFETY RELIEF VALVE





Please note the two BTU ratings. For fired storage water heaters or hot water supply storage vessels. The CSA or AGA rating of the valve must meet or exceed the BTU input as indicated from the manufacture lable.

National Board - The CSA rating replaces the AGA rating used up until approximately the year 2000. From an inspector's point of view, nothing has changed except the name of the rating organization.

Selecting T&P Valves

To select a T&P valve some basic application factors must be considered: sizing, location in the water heater and draining. Sizing the valve is based on ensuring that the valve discharge rating is in excess of the BTU input as indicated on the manufacturer's label on the heater. The valve must be capable of discharging more BTU's than the heater is capable of putting into the water.

CSA Temperature Steam Rating

The CSA temperature steam rating, the method used under ANSI standard Z21.22, used nationally for sizing relief valves. The rating is obtained initially on a test tank where 15psi of steam pressure is accumulated. Under these conditions, the thermostat has opened the valve, and the steam flows through the orifice into an accumulating tank where it is measured and translated into a valve rating. This is the safest form of rating relief valves because it takes into consideration the fact that no water pressure is available to the heater. Therefore, it covers all potential elements that could affect the relieving capacity.

ASME Pressure Steam Rating

The ASME pressure steam rating should be considered with caution, because it represents the ability of the device to discharge steam pressure at the set pressure of the valve. For example, let's consider a 150psi set relief valve with an ASME pressure steam rating of 1,437,600 BTU per hour. Before this valve can deliver that rating, there must be generated within the tank over 150psi of steam pressure in order to actuate the valve. This is certainly an unsafe condition for a non-ASMErated water heater tank. The tank could rupture and explode prior to reaching this ASME pressure rating. An ASME-rated tank is constructed to higher standards than a non-rated tank. It is important to understand which type of tank will be used in an application. For all non-ASME-rated tanks, the CSA temperature steam rating should always be used.

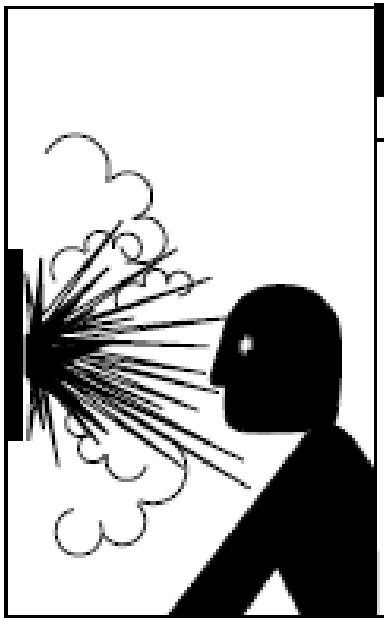
TESTING RELIEF VALVES

From the National Board Website –
In the event of a control failure which may cause a runaway firing condition, the only safety device which will prevent a catastrophic failure of the hot water vessel is the T&P relief valve.
In view of this, it is imperative that the T&P relief valve be inspected and tested regularly.
Since the T&P relief valve is constructed to relieve on either pressure or temperature, manually testing the valve with the test lever only tests the mechanical freedom of movement of the valve and ensures the waterways are clear.
Manufacturers recommend that valves that have been in service more than three years be removed and visually inspected for accumulations of corrosion deposits, such as those shown in the photographs.

The valve should also be inspected for proper installation. The valve probe must be immersed in tank water and be **located in the top six inches of the tank** in order for it to accurately sense tank water temperature. Improper installation, such as that shown below, could render the valve ineffective because it cannot sense actual tank water temperature.

Valve piping must also be inspected to ensure the outlet of the valve has not been reduced, and is pitched down for free draining with no shut-off valves or other obstructions in the valve drain pipe.
Check the valve nameplate, ensure the pressure relief setting does not exceed the maximum allowable working pressure of the tank, **and be sure that the CSA/A.G.A. rating is in excess of the Btu input of the heater.**

Temperature and Pressure Relief Valve



⚠WARNING

Explosion Hazard

- Temperature-pressure relief valve must comply with ANSI Z21.22-CSA 4.4 and ASME code.
- Properly sized temperature-pressure relief valve must be installed in opening provided.
- Can result in overheating and excessive tank pressure.
- Can cause serious injury or death.

Manually operate the temperature and pressure relief valve at least once a year to make sure it is working properly. To prevent water damage, the valve must be properly connected to a discharge line which terminates at an adequate drain. Standing clear of the outlet (discharged water may be hot), slowly lift and release the lever handle on the temperature and pressure relief valve to allow the valve to operate freely and return to its closed position. See Figure 25. If the valve fails to completely reset and continues to release water, immediately shut off the manual gas control valve and the cold water inlet valve and call a qualified technician.

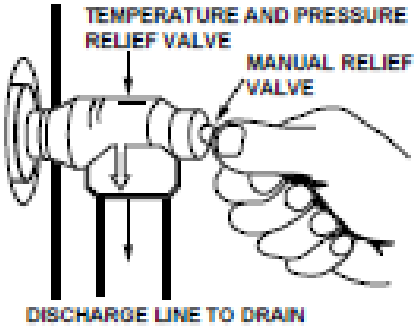
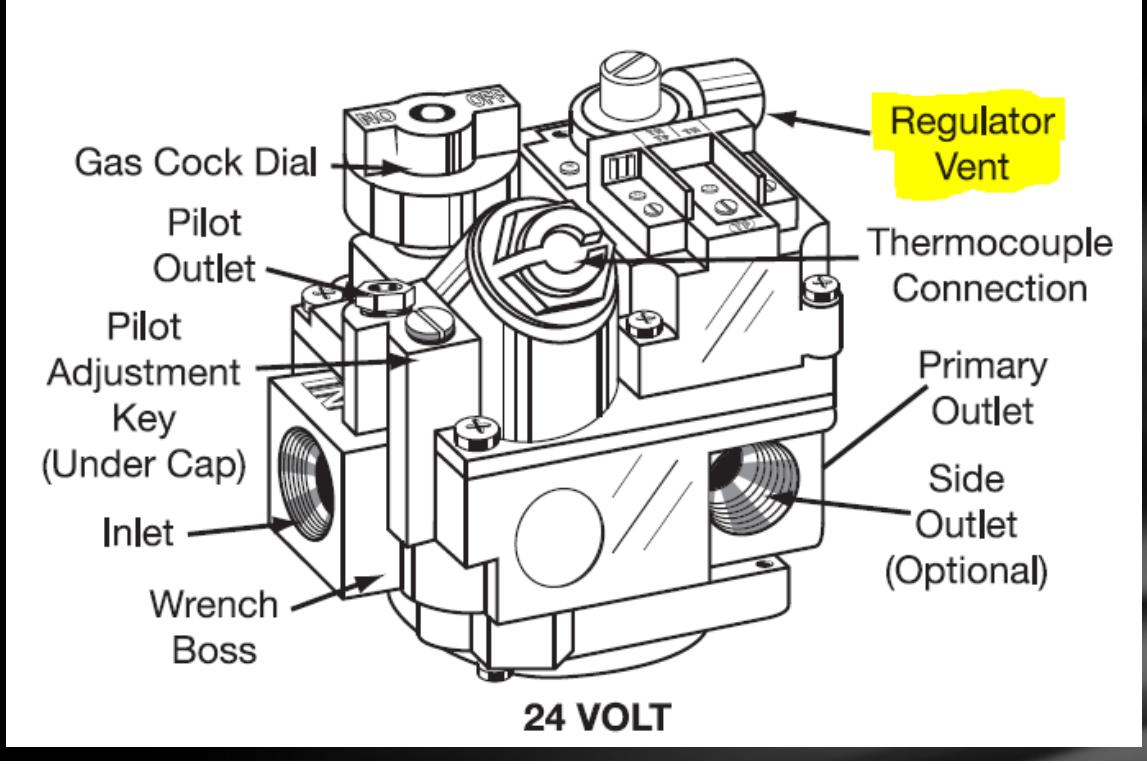


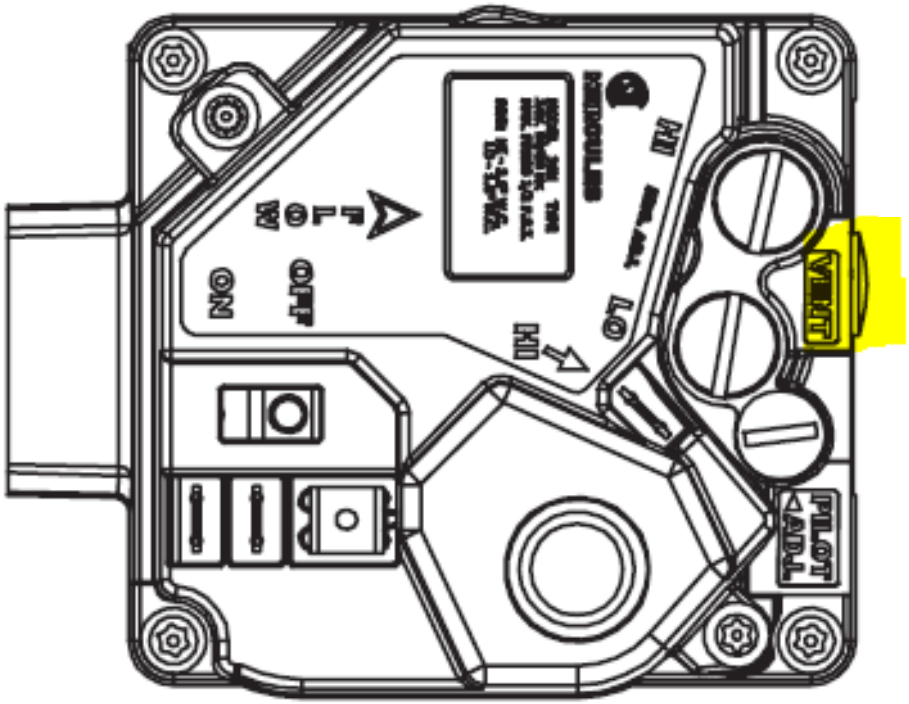
FIGURE 25.

HOW TO TEST YOUR T&P - VIDEO



PRESSURE REGULATOR VENT

The 700 Series Gas Control when equipped with a pressure regulator, has as standard equipment a built-in Vent Limiter. The regulator vent is tapped 1/8" tubing if vent tubing is required. This lifting is available in a package of 15, order 4590-065. **CAUTION:** If bleed tubing is used, do not allow main burner or pilot flame impingement on the tubing as this will eventually cause clogging of the tubing and improper regulator operation. If bleed tubing is not used, the regulator vent must be properly shielded from moisture.



NOTE

All piping must comply with local codes, ordinances, and/or national fuel gas codes.

Article 50.—GENERAL REQUIREMENTS FOR ALL BOILERS

49-50-22 Venting of atmospheric vents, gas vents, and bleed or relief lines.

(a) Each gas pressure regulator, pressure switch, safety shutoff valve, and any other gas control that has a threaded fitting shall be vented to the outdoors to a safe point of discharge. The material for each vent line shall be metallic, in accordance with the standards in NFPA 54, which is adopted in K.A.R. 49-50-2.

STATE OF KANSAS DOES NOT ACCEPT VENT LIMITERS AS SUFFICIENT VENTING

GAS VENTING CONT'D

49-50-22 Venting of atmospheric vents, gas vents, and bleed or relief lines.

(a) Each gas pressure regulator, pressure switch, safety shutoff valve, and any other gas control that has a threaded fitting shall be vented to the outdoors to a safe point of discharge. The material for each vent line shall be metallic, in accordance with the standards in NFPA 54, which is adopted in K.A.R. 49-50-2.

(b) The atmospheric vent lines shall not be connected to any common gas vent, to any threaded gas vent, or to any bleed or relief line on any double-block-and-bleed fuel train. **Each boiler shall be vented separately.**

(c) Each atmospheric vent line that has a threaded connection shall be manifolded together in a common atmospheric vent line having a cross-sectional area that is not less than the area of the largest vent line plus 50% of the total areas of the additional vent lines.

(d) Each gas regulator and each pressure interlock switch, as well as any other fuel train component that requires atmospheric pressure to balance diaphragms or other similar devices, shall be provided with a pipe threaded connection for its vent line. The vent line shall be extended outdoors to a safe point of discharge. A means shall be provided at the vent line's terminating point to prevent blockage of the line by foreign material, moisture, or insects.

(e) Each vent line and actuating line inside boiler casings shall be made of metallic material. (Authorized by and implementing K.S.A. 44-916; effective April 28, 2000; amended Nov. 3, 2006.)

As per adopted CSD-1. The vent line may terminate at the point of a standing pilot. To allow any excess gas to be burned off.

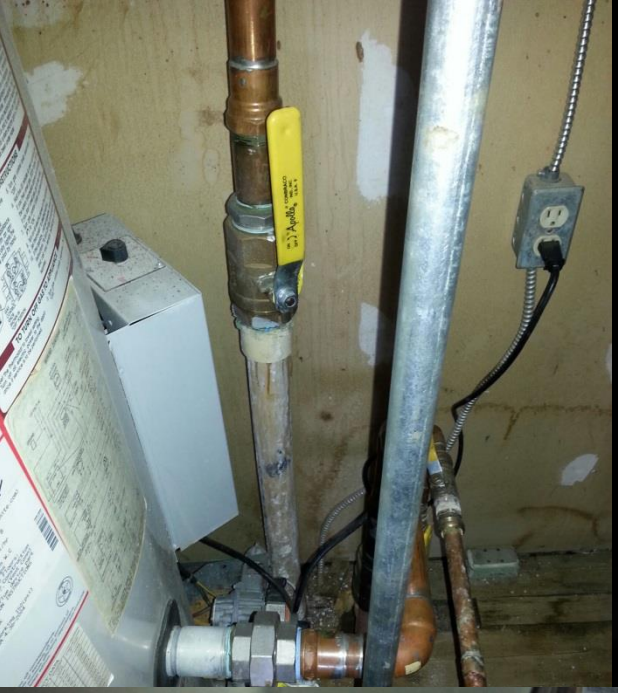

CASH ACME
TYPE FVMX-4LS
SERIES 4
SIZE 1 IN
4 IN
SET 150 PSI-210°F
MAX HEATER INPUT BTU/HR 500,000
ASME
ANSI Z21.22
RELIEF VALVES

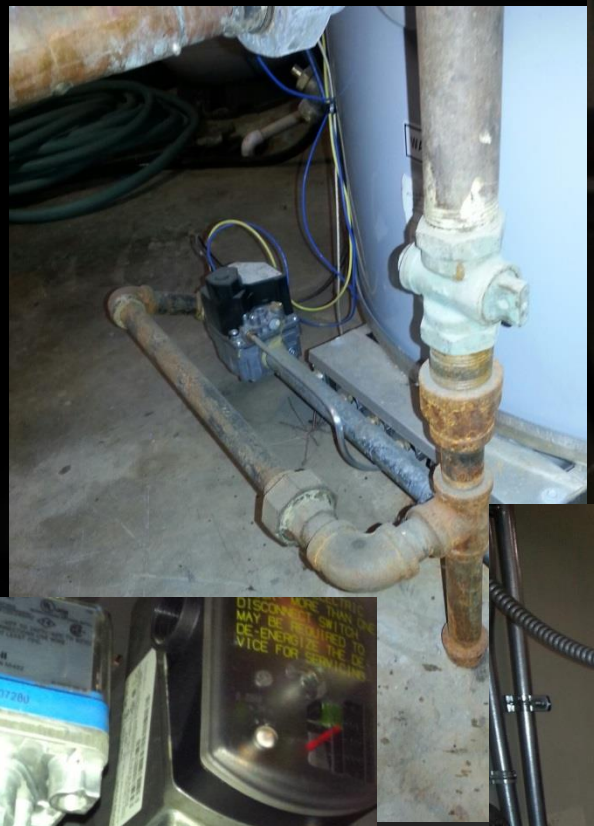

ANODE ACCESS

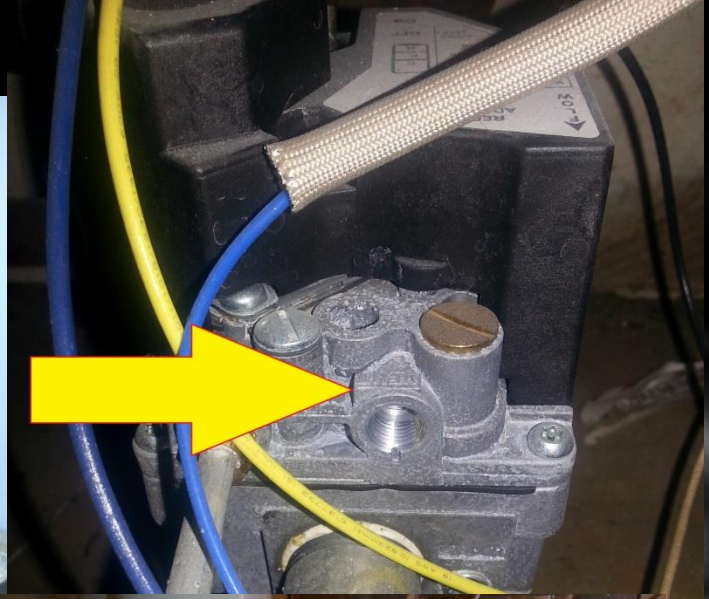

DANGER
CEC

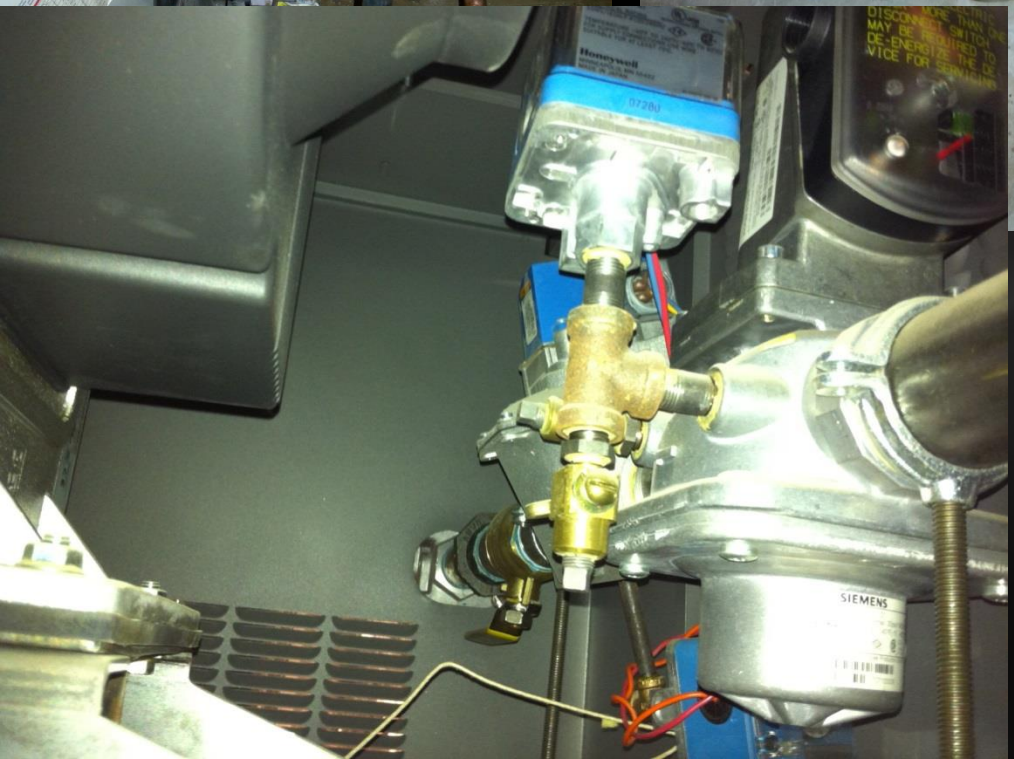

WATER OUTLET
A.O.Smith
Master-Fit
Ultra Coat


Water Supply Systems, ANSI Z21.22 shall be installed at the time of installation of the heater in the location specified by the manufacturer. Local codes shall govern installation of relief devices. For safe operation of the water heater, the relief valve must not be removed or plugged.
M15 STD. Z21.22
SET 150 PSI 210°F
40XL
1,438,000

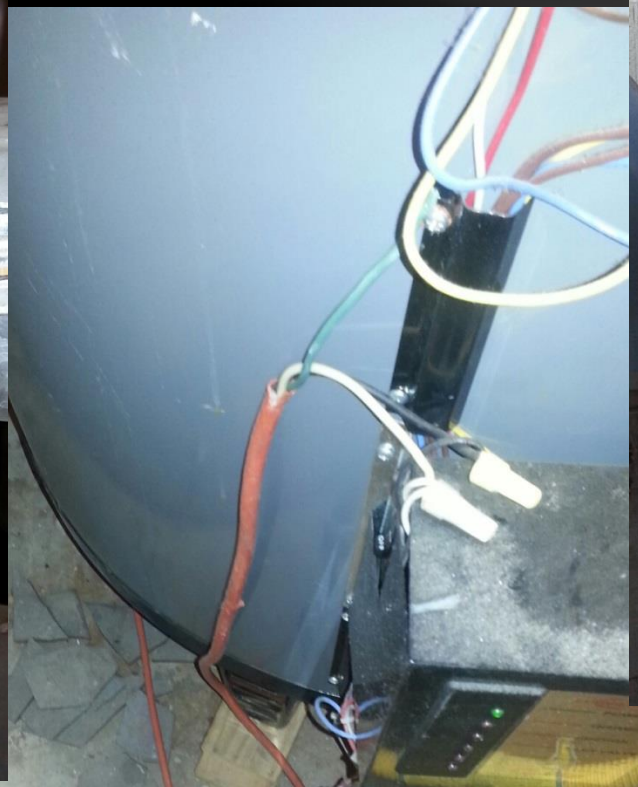


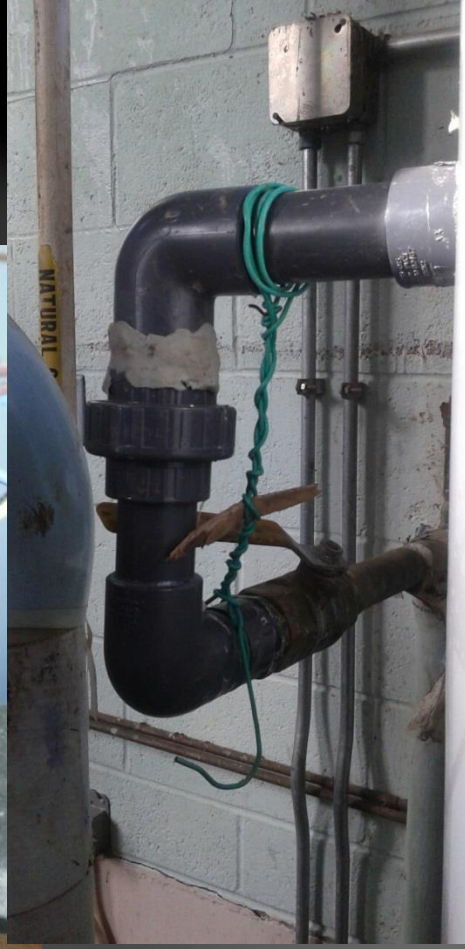





SIEMENS


VENT LIMITING DEVICE




NATURAL

Questions

Hope you've enjoyed this presentation. Have an excellent day.